plainly; and not only may stereographs be combined by the eyes, more readily and with less fatigue than when using an instrument, but they may as readily be inverted (the near objects appearing distant, and *vice versâ*, as if falsely mounted) by applying each eye to the picture in front of the other, in fact, squinting at it. Thus, pictures of any size can be properly combined by reversing the pictures and crossing the eyes, and the width of the pictures is not limited to the distance between the eyes as in the ordinary way.

An important use of stereoscopic vision is to throw one eye out of use when doing delicate measurement, &c., by directing it to some other and darker object, instead of shutting it; this is less fatigue, and the attention may be willed on to the eye required, so that the image of the other is not noticed, especially if the eyes be changed occasionally.

How far the fact of the eyes changing guard naturally by alternations, may suggest that all duplicated organs of the body have alternate periods of rest, I must leave physiologists to investigate. W. M. FLINDERS PETRIE

Bromley, Kent

Inside Out

IT appears in NATURE, vol. xviii. p. 105, that "if a fourth dimension were added to space, a closed material surface (or shell) could be turned inside out by simple flexure." This implies that flexure is necessary. But without displacing a point or a line in the surface we may consistently suppose a rotation of the normals at each point of it through two right angles in a plane polar to the tangent plane. That seems to do the business. C. J. MONRO

May 28

Physical Science for Artists

MR. NORMAN LOCKYER, in NATURE, vol. xviii., pp. 59, 60, gives some valuable hints to artists, which, if carried out, will go a great way towards preventing our eyes being hurt by the lunar monstrosities we see at the Royal Academy and elsewhere.

May I be permitted to add a hint which he appears to have overlooked, and that is, that the inside boundary of a crescent moon is an ellipse; and in this consists the peculiar beauty of a true crescent. The usual Turkish crescent is struck with two circles, and always looks gouty and bad. Of course the rough edge of a gibbous moon is also an ellipse.

Scientific Club, 7, Savile Row, W., ROBERT J. LECKY

May 25

Dr. P. P. Carpenter's Collection

MAY I ask you to correct an error in the "Notes" of your number for April 25th, relating to the collection of the late Dr. P. P. Carpenter. This collection was permanently placed by him in the museum of this university; and, mounted under his direction on glass tablets, it now occupies a separate fire-proof room erected for it by the university, and constitutes one of the principal scientific treasures of this university and of Canada. Your correspondent was probably misled by the fact that one of the best duplicate sets was reserved by Dr. Carpenter for his own use in his private residence. This has not been publicly offered for sale, but I believe has been privately offered to certain persons and institutions considered likely to value it.

McGill College, Montreal, May 10 J. W. DAWSON

Menziesia Cærulea

IN confirmation of the recent occurrence of the above plant on the Sow of Athol, I may say that it was gathered by Miss Crawford in 1877, from whom I received a specimen. Like the cotoneaster on the Orme, which has also been reported extinct, careful and prolonged search has generally been rewarded by finding specimens, although the cotoneaster is now very rare. I might take this opportunity of saying that the rare spider orchis, *Ophrys aranifera*, which the Rev. M. J. Berkeley has gathered at Southorpe, in Northants, has been destroyed there by the planting of larch. I made a most careful search not only at Southorpe but on the Barnack hills last week, but without seeing a trace of the *orchis*, although *Anemone pulsatilla* and *Aceras anthropophora* are still abundant on the unplanted quarries.

Northampton Natural History Society G. C. DRUCE

Landrails

IT would prove very interesting to know whether landrails are as plentiful in other parts of the country this season as they are in the neighbourhood of Sheffield. They have not visited us in any numbers since the spring and summer of 1875; in 1876 and 1877 scarcely one was heard; while at the present time we hear their well-known calls in almost every meadow. I know of no migratory British bird in whose case this peculiar irregularity of appearance occurs in such high degree as in the landrail.

If the advice of one interested in the subject may be humbly offered, I would recommend ornithologists to pay strict attention to this matter, this season, with a view of elucidating this peculiar trait in the life-history of this singular bird; for the cause of this irregular appearance has, for aught I know to the contrary, yet to be learned. CHARLES DIXON

Heeley, near Sheffield, May 20

Hereditary Transmission

THE letter of Mr. Watt reminds me of a similar instance of "Hereditary Transmission" mentioned in the ninth edition of the "Encyclopædia Britannica."

It is there stated that "George Bernhard Bilfinger was born on January 23, 1693, at Cannstadt, in Würtemberg. His father was a Lutheran minister. By a singularity of constitution, hereditary in his family, Bilfinger came into the world with twelve fingers and as many toes."

After being a Professor of Logic at St. Petersburg University Bilfinger became one of the "best and most enlightened ministers" of state that Würtemberg had yet produced.

Burngreave Road, Sheffield, GEORGE S. WATSON

May 25

THE PHONOGRAPH AND ITS FUTURE

WHAT a surprise is in store for the children next Christmas if Mr. Edison's expectations are realised. Dolls that can say "papa" and "mamma," will be quite at a discount and will bear much the same relation to the doll of the future that the anthropoid ape does to the man of to-day, and the time will probably have come for some Darwinian toy-maker to write the history of doll development, if, indeed, he does not extend his researches to the whole world of toys. We are promised dolls that can speak, sing, cry, laugh; musical-boxes that will grind out the voice and words of the human singer; locomotives and every other species of "animal and mechanical toy," that will give out their natural and characteristic sounds.

But these are only some of the trifles to which Mr. Edison, in an interesting article in the current *North American Review*, tells us his miraculous invention will certainly or probably be put in the near future. And, indeed, a very little consideration will show that there is no end to the uses to which the principle of the phonograph may be applied; that it may be the means of actually realising some of the wildest dreams and speculations of the "frenzied" poet and preacher, and creating a revolution in human intercourse only to be paralleled by the invention of printing, or even of speech itself. Indeed, at first sight it may seem a step backwards, as it is likely to lead to the abolition, to some extent, of writing and printing, and the substitution of the human voice as the main means of intercourse at a distance. Talk of the solidification of the gases! Why we have here the solidification of something infinitely more impalpable—human words and human thought. We referred above to the musical-box of the future, and this suggests the phonographic barrel-organ, which will doubtless by and by take the place of that instrument of torture which makes the lives of delicate-eared artists and *littérateurs* miserable. Instead of having our musical sensibilities harrowed by a murdered reproduction of our favourite operatic air, or our political sympathies shocked

by some wretched effusion of the Jingoid type, we shall have those picturesque Italian girls, with their bandit-looking companions, turning out for us a ballad by Sims Reeves or Santley, or a witching air in the voice of Patti. Alas! the invention came just too late to preserve to us for ever the matchless voice of Titiens, for now we need not wish in vain for "the sound of a voice that is still."

Music inevitably suggests love, and the tender cooings of the "lover and his lass, with a heigh and a ho and a heigh no nino." No longer will the far-separated pair have to wait weary weeks or months for a clumsy letter, when phonograph offices are as plentiful as telegraph stations; and when Mr. Edison has managed to make those improvements on the instrument of which he is confident, it will be quite possible for the fond pair to have a daily meeting and exchange across the world all sorts of tender cooings—for sounds of every kind can be registered on and given out by the phonograph.

Mr. Edison tells us that for these and similar purposes he is now perfecting the instrument in mechanical details. "The main utility of the phonograph, however, being for the purpose of letter-writing and other forms of dictation, the design is made with a view to its utility for that purpose.

"The general principles of construction are a flat plate or disk, with spiral groove on the face, operated by clock-work underneath the plate; the grooves are cut very closely together, so as to give a great total length to each inch of surface—a close calculation gives as the capacity of each sheet of foil, upon which the record is had, in the neighbourhood of 40,000 words. The sheets being but ten inches square, the cost is so trifling that but 100 words might be put upon a single sheet economically.

"The practical application of this form of phonograph for communications is very simple. A sheet of foil is placed in the phonograph, the clock-work set in motion, and the matter dictated into the mouth-piece without other effort than when dictating to a stenographer. It is then removed, placed in a suitable form of envelope, and sent through the ordinary channels to the correspondent for whom designed. He, placing it upon his phonograph, starts his clock-work and *listens* to what his correspondent has to say. Inasmuch as it gives the tone of voice of his correspondent, it is *identified*. As it may be filed away as other letters, and at any subsequent time reproduced, it is a perfect *record*. As two sheets of foil have been indented with the same facility as a single sheet, the 'writer' may thus *keep a duplicate* of his communication.

"The phonograph letters may be dictated at home, or in the office of a friend, the *presence* of a stenographer *not being required*. The dictation may be as rapid as the thoughts can be formed, or the lips utter them. The recipient may listen to his letters being read at a rate of from 150 to 200 words per minute, and at the same time busy himself about other matters. Interjections, explanations, emphasis, exclamations, etc., may be thrown into such letters, *ad libitum*.

"The advantages of such an innovation upon the present slow, tedious, and costly methods are too numerous, and too readily suggest themselves, to warrant their enumeration, while there are no disadvantages which will not disappear coincident with the general introduction of the new method."

Then as to books there seems some chance that, ere long the printer's, if not the publisher's, occupation will be to a great extent gone, and the present unwieldy form of communication between an author and his readers be abolished. What would not one give to have the "Christmas Carol" bottled up for ever in Dickens's own voice to be turned out at pleasure? Books, as Mr. Edison truly says, would often be listened to where none are read, and the possibilities of the instrument in this direction may be learned from the fact that a book of 40,000 words might be recorded on a single metal plate ten inches square. We need not point out the uses to which the invention might be put for the preservation of the greatest efforts of our greatest orators, but when Mr. Edison speaks of our thus collecting and preserving "the last words of the dying member of the family" and of great men, we feel as if he were approaching both the ludicrous and the shocking.

Then the compositor will be able to set up his type by ear instead of eye, and we shall have phonographic clocks which "will tell you the hour of the day, call you to lunch, send your lover home at ten," &c.

"Lastly, and in quite another direction, the phonograph will *perfect the telephone*, and revolutionise present *systems of telegraphy*. That useful invention is now restricted in its field of operation by reason of the fact that it is a means of communication which leaves no record of its transactions, thus restricting its use to simple conversational chit-chat, and such unimportant details of business as are not considered of sufficient importance to record. Were this different, and our telephone conversation automatically recorded, we should find the reverse of the present status of the telephone. It would be expressly resorted to *as* a means of perfect record.

"'How can this application be made?' will probably be asked by those unfamiliar with either the telephone or phonograph.

"Both these inventions cause a plate or disc to vibrate, and thus produce sound-waves in harmony with those of the voice of the speaker. A very simple device may be made by which the one vibrating disc may be made to do duty for both the telephone and the phonograph, thus enabling the speaker to *simultaneously transmit and record his message*. What system of telegraphy can approach that? A similar combination at the distant end of the wire enables the correspondent, if he is present, *to hear it while it is being recorded*. Thus we have a mere passage of words for the action, but a complete and durable record of those words as the result of that action. Can economy of time or money go further than to annihilate time and space, and bottle up for posterity the mere utterance of man, without other effort on his part than to speak the words?

"The telegraph company of the future—and that no distant one—will be simply an organisation having a huge system of wires, central and sub-central stations, managed by skilled attendants, whose sole duty it will be to keep wires in proper repair, and give, by switch or shunt arrangement, prompt attention to subscriber No. 923 in New York, when he signals his desire to have private communication with subscriber No. 1001 in Boston, for three minutes. The minor and totally inconsequent details which seem to arise as obstacles in the eyes of the groove-travelling telegraph-man, wedded to existing methods, will wholly disappear before that remorseless Juggernaut—"the needs of man;" for, will not the necessities of man surmount trifles in order to reap the full benefit of an invention which practically brings him face to face with whom he will; and, better still, doing the work of a conscientious and infallible scribe?"

Mr. Edison is certainly very hopeful of the future of the wonderful instrument he has invented, but we think, not too hopeful; for, after the invention itself and its most recent development, the microphone, it would be rash to say that any application of it is impossible. Certainly some substitute or substitutes for the clumsy mode of recording our thoughts by pen and ink, so inconsistent with the general rapidity of our time, must be close at hand; and what form one of these substitutes may take seems pretty clearly pointed out by the actual uses to which Mr. Edison's invention has been put.